NEVADA
NEXT GENERATION
SCIENCE EDUCATION

Nevada State Science Standards Revision: Why NGSS?

Nevada
Department
of Education

Overview of Presentation

- Collaborating and Reaching Consensus
- Building on the Past; Preparing for the Future
- Improving Science Education in Nevada
- Applying the Next Generation Science Standards
- Preparing Nevada Students for Success

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Presenters

- Bret Sibley: K-12 Science Education Trainer; Southern Nevada Regional Professional Development Program (SNRPDP)
- Dave Crowther: Executive Director of the Raggio Research Center for STEM Education and Professor Science Education; University of Nevada, Reno
- Mary Pike: Director of K-12 Science, Health, Physical Education, Foreign Language, and Driver Education (SHPEFLDE); Curriculum & Professional Development Division –Clark County School District

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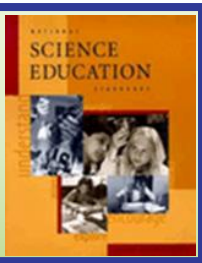
Building on the Past; Preparing for the Future

National Science Education Standards (1996)



- **Science Teaching Standards**
  - (Inquiry, learning, assessment of teaching, environment, learning communities, and school based programs)
- **Standards for Professional Development**
  - (Inquiry, integration of PCK, lifelong learning, coherence)
- **Assessment in Science Standards**
- **Science Content Standards**
  - (Unifying concepts and processes, Inquiry, Physical, Life, Earth / Space, Science & Technology, Science and Society, History of Science)
- **Science Education Program Standards**
- **Science Education System Standards**
  - (Policy from school – district – state – nation)

Inquiry into authentic questions generated from student experiences is the central strategy for teaching science.

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Building Capacity for State Science Education (BCSSE)

- Achieve
- American Association for the Advancement of Science
- Carnegie Corporation of New York
- The GE Foundation
- The Cisco Foundation
- DuPont
- National Research Council
- National Science Teachers Association
- The Noyce Foundation

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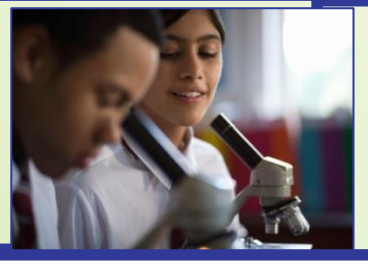
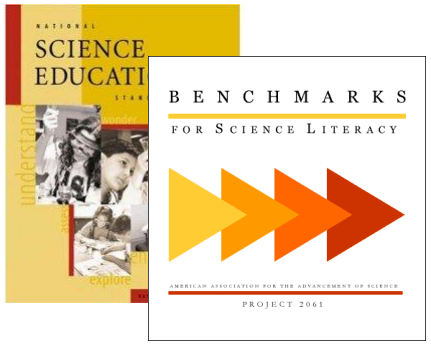
Building on the Past; Preparing for the Future

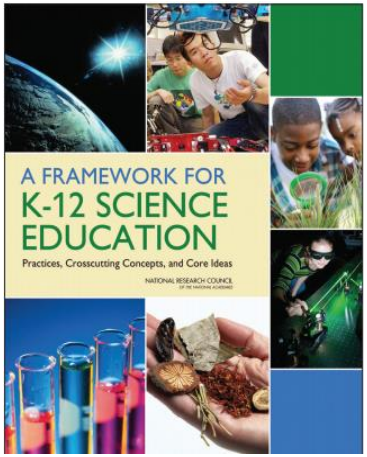




1990s

Phase I

Phase II

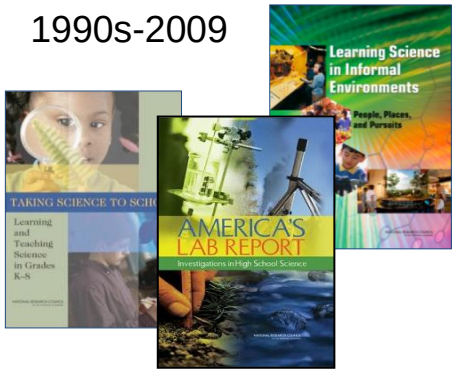


1/2010 - 7/2011

NEXT GENERATION SCIENCE STANDARDS
For States, By States

7/2010 – Early 2013

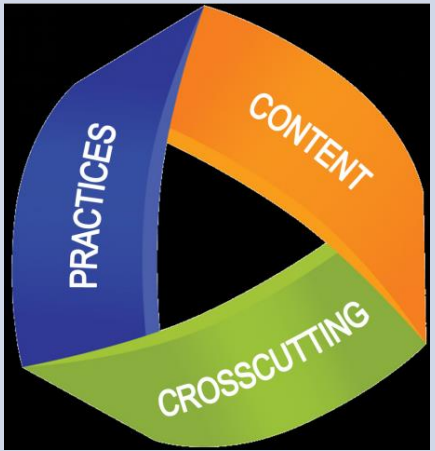
1990s-2009



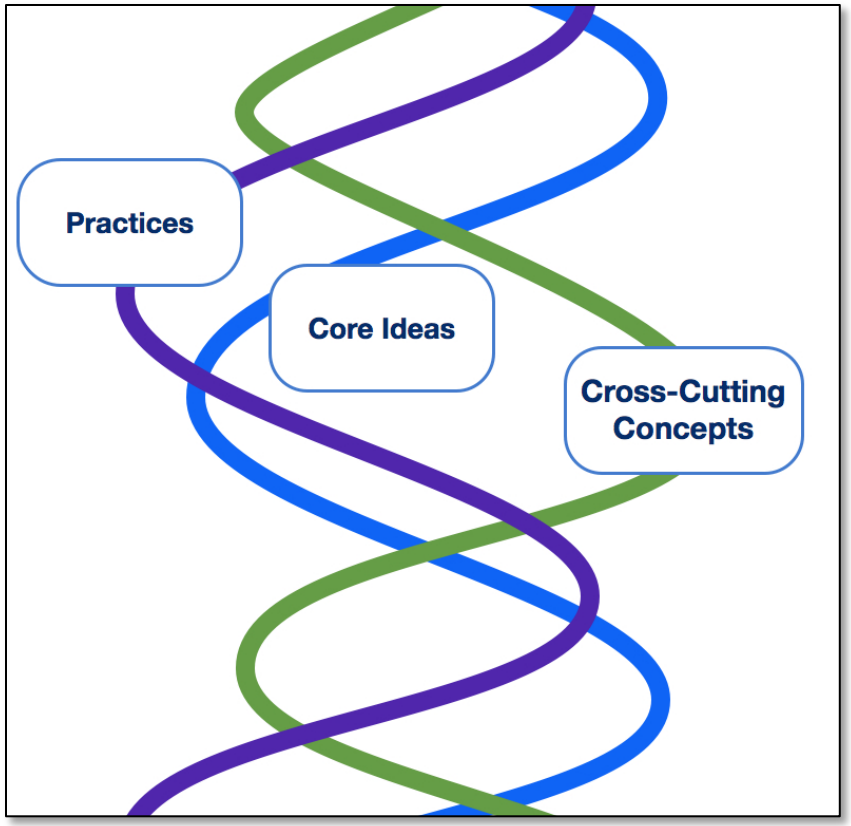
Structure of NGSS

- Three Dimensions
  - Disciplinary Core Ideas
  - Cross Cutting Concepts
  - Science and Engineering Practice
- Connections
  - Content Clarification Statements
  - Assessment Boundaries (performance expectations)
  - Common Core State Standards (ELA & Math)

Framework for K-12 Science Education and Next Generation Science Standards (NGSS)

1. Scientific and Engineering Practices ***NSES – Process Skills, Inquiry, and Nature of Science***	2. Crosscutting Concepts **NSES – Unifying Concepts**	3. Disciplinary Core Ideas **NSES Science Content** **Adds Engineering and STEM**
1. Asking questions (for science) and defining problems (for engineering) 2. Developing and using models 3. Planning and carrying out investigations 4. Analyzing and interpreting data 5. Using mathematics and computational thinking 6. Constructing explanations (for science) and designing solutions (for engineering) 7. Engaging in argument from evidence 8. Obtaining, evaluating, and communicating information	1. Patterns 2. Cause and effect: Mechanism and explanation 3. Scale, proportion, and quantity 4. Systems and system models 5. Energy and matter: Flows, cycles, and conservation 6. Structure and function 7. Stability and change ***Utilizes History of Science and Social and personal perspectives***	• Physical Sciences • Life Sciences • Earth and Space Sciences • Engineering, Technology, and the Applications of Science 

Three Dimensions Intertwined



What is new?

1. Central role of scientific and engineering practices
2. Organized around crosscutting concepts & core explanatory ideas
3. Organized in learning progressions

Conceptual Shifts in the NGSS

1. K–12 science education should reflect the interconnected nature of science as it is practiced and experienced in the real world.
2. The NGSS are student performance expectations not curriculum.
3. Science concepts build coherently across K-12.
4. The NGSS focus on deeper understanding of content as well as application of content.
5. Science and engineering are integrated in the NGSS, from K-12
6. The NGSS are designed to prepare students for college, career, and citizenship.
7. The NGSS and Common Core State Standards (English Language Arts and Mathematics) are aligned.

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Role of "New" Standards

What they all have in common:

- To update previous content and practices
- To increase depth of knowledge over breadth
- To include cognitive research developed over the past 20 years
- To increase problem solving and critical thinking
- To develop 21st century skills
- To help children become career or college ready
- To show natural connections between content areas

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Collaborating and Reaching Consensus

Nevada Plan of Action

- Articulate the *Framework for K-12 Science Education* to stakeholders of Nevada science education.
- Convene as a State committee to decide if this revision of the Nevada State Science Standards is best for Nevada students.
- Develop science education partnerships within Nevada and nationwide to foster statewide leadership that understands the Framework's vision.
- Offer a mode of transition between the current and proposed science standards.

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Nevada's Science Education Stakeholders

- Carson County School District
- Challenger Learning Center of Northern Nevada
- Churchill County School District
- Clark County School District
- Click Bond
- Douglas County School District
- Dream It Do It
- DRI
- DRI Greenpower
- Elko County School District
- EPSCoR
- Exhibit IQ, Inc.
- FIRST Nevada – North
- FIRST Nevada – South
- iNNOVATE22
- KNPB Channel 5 Public Broadcasting
- Las Vegas Science Festival
- Lemelson Education and Assistance Program
- Lincoln County School District
- Lyon County School District
- Mendenhall Innovation Program, College of Engineering, UNLV
- MESA Northern Nevada
- Mineral County School District
- Nevada Arts Council
- Nevada Department of Employment, Training and Rehabilitation
- Nevada Department of Education
- Nevada Outdoor School
- Nevada State Science Teachers Association
- Nevada STEM Education Planning Group
- Northeast Nevada Regional Professional Development Program (NERPDP)
- Northern Nevada FIRST Lego League
- Northwest Nevada Regional Professional Development Program (NWRPDP)
- Nye County School District
- Office of Lieutenant Governor
- Sierra NV Journeys
- Southern Nevada Regional Professional Development Program (SNRPDP)
- Space Science for Schools, Inc.
- Terry Lee Wells Nevada Discovery Museum
- Truckee Meadows Community College
- Vegas PBS
- Raggio Research Center for STEM Education -UNR
- Storey County School District
- Washoe County School District
- Western Nevada College
- WestED

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The Challenges…

- Access/development of resources
- Geographic isolation
- Partnership development

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The Accomplishments…

- Collaborating with state-level science program professionals from 46 other states and territories.
- Development of science education partnerships between business/industry, higher education, community groups, informal education, state-, district and school-level science educators within Nevada.
- Networking of science education stakeholders via Nevada's science conferences through the Nevada Next Generation Science Education (NNGSE) website.

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This revision will offer a systemic approach to improve Nevada's science education.

K-12 Science Framework:
Vision and Broad Learning Goals

NSASS and the NGSS Standards:
Student Assessment Performances

* Curriculum
* Teaching Materials
* PD System
* Teacher Prep courses
* Assessments for teaching and learning

Large-scale Assessments:
How will attainment of goals be measured?

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Improving Science Education in Nevada

Nevada State Science Standards vs. Next Generation Science Standards

NSSS

- Life Science
- Physical Science
- Earth & Space Science
- None
- Nature of Science (History of Science, Technology, Process Skills & Inquiry)
- Grade Bands (K-2, 3-5, 6-8, 9-12)
- Mile Wide/Inch Deep

NGSS

- Life Sciences
- Physical Sciences
- Earth & Space Sciences
- Engineering & Technology Applications to Science
- Science Practices
- Grade Levels (K, 1, 2, 3, 4, 5, 6-8, 9-12)
- In-depth Coverage of Fewer Concepts

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Nevada State Academic Science Standards

Strand and Unifying Concept

Scientific Inquiry (Nature of Science Unifying Concept A)

Scientific inquiry is the process by which humans systematically examine the natural world. Scientific inquiry is a human endeavor and involves observation, reasoning, insight, energy, skill, and creativity. Scientific inquiry is used to formulate and test explanations of nature through observation, experiments, and theoretical or mathematical models. Scientific explanations and evidence are constantly reviewed and examined by others. Questioning, response to criticism and open communication are integral to the process of science.

By the end of the grade band:		By the end of the grade band, students know and are able to do everything required in earlier grades and:		By the end of grade band, students know and are able to do everything required in earlier grades and:		By the end of grade band, students know and are able to do everything required in earlier grades and:	
		Grades 3 - 5		**Grades 6 - 8**		**Grades 9 - 12**	
N.2.A	**Students understand that science is an active process of systematically examining the natural world.**	N.5.A	**Students understand that science involves asking and answering questions and comparing the answers to what scientists know about the world.**	N.8.A	**Students understand that scientific knowledge requires critical consideration of verifiable evidence obtained from inquiry and appropriate investigations.**	N.12.A	**Students understand that a variety of communication methods can be used to share scientific information.**
N.2.A.1	Students know how to make **observations** and give descriptions using words, numbers, and drawings. E/S	N.5.A.1	Students know scientific progress is made by conducting careful **investigations**, recording data, and communicating the results in an accurate method. E/S	N.8.A.1	Students know how to identify and critically evaluate information in data, tables, and graphs. E/S	N.12.A.1	Students know tables, charts, illustrations and graphs can be used in making arguments and claims in oral and written presentations. E/S
		N.5.A.2	Students know how to compare the results of their experiments to what scientists already know about the world. I/L	N.8.A.2	Students know how to critically evaluate information to distinguish between fact and opinion. E/S	N.12.A.2	Students know scientists maintain a permanent record of procedures, data, analyses, decisions, and understandings of scientific investigations. I/S
		N.8.A.3	Students know how to draw **conclusions** from scientific **evidence**. E/S	N.8.A.3	Students know different explanations can be given for the same evidence. E/S	N.12.A.3	Students know repeated experimentation allows for statistical analysis and unbiased conclusions. E/S
		N.5.A.4	Students know graphic representations of recorded data can be used to make predictions. E/S				

Standard

Benchmark

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NEXT GENERATION SCIENCE STANDARDS
For States, By States

Performance Expectations

Foundation Boxes

Connection Boxes

MS.PS-SPM Structure and Properties of Matter

MS.PS-SPM Structure and Properties of Matter

Students who demonstrate understanding can:

a. **Construct and use models to explain that atoms combine to form new substances of varying complexity in terms of the number of atoms and repeating subunits.** [Clarification Statement: Examples of atoms combining can include Hydrogen (H_2) and Oxygen (O_2) combining to form hydrogen peroxide (H_2O_2) or water (H_2O).] [Assessment Boundary: Valence electrons and bonding energy are not addressed.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Developing and Using Models

Modeling in 6–8 builds on K–5 and progresses to developing, using and revising models to explain, explore, and predict more abstract phenomena and design systems.

- Use and/or construct models to predict, explain, and/or collect data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs. (a)

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter

- All substances are made from some 100 different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (a)
- Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (a)

Crosscutting Concepts

Patterns

Macroscopic patterns are related to the nature of microscopic and atomic-level structure. Patterns in rates of change and other numerical relationships can provide information about natural and human designed systems. Patterns can be used to identify cause and effect relationships. Graphs and charts can be used to identify patterns in data. (a)

Connections to other DCIs in this grade-level: **MS.ESS-ESP, MS.ESS-SS, MS.LS-MEOE**

Articulation of DCIs across grade-levels: **3.IF, 5.SPM, HS.PS.SPM, HS.PS-NP, HS.PS-E**

Common Core State Standards Connections: [Note: these connections will be made more explicit and complete in future draft releases]

ELA–

W.5.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
W.6.1 Write arguments to support claims with clear reasons and relevant evidence.
W.7.1 Write arguments to support claims with clear reasons and relevant evidence.
SL.5.4 Report on a topic or text or present an opinion, sequencing ideas logically and using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.
SL.6.4 Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.
SL.7.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation.
WHST.6-8.1 Write arguments focused on discipline-specific content.
RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

Mathematics–

MP.4 Model with mathematics.
MP.8 Look for and express regularity in repeated reasoning.
6.SP Develop understanding of statistical variability
Summarize and describe distributions

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For States, By States

Performance Expectations

Foundation Boxes

MS.PS-SPM Structure and Properties of Matter

MS.PS-SPM Structure and Properties of Matter

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Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 6–8 builds on K–5 and progresses to developing, using and revising models to explain, explore, and predict more abstract phenomena and design systems. ▪ Use and/or construct models to predict, explain, and/or collect data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs. (a)	**PS1.A: Structure and Properties of Matter** ▪ All substances are made from some 100 different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (a) ▪ Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (a)	**Patterns** Macroscopic patterns are related to the nature of microscopic and atomic-level structure. Patterns in rates of change and other numerical relationships can provide information about natural and human designed systems. Patterns can be used to identify cause and effect relationships. Graphs and charts can be used to identify patterns in data. (a)

Language was based on Framework and expanded into Matrices

NRC Framework language from Grade Band Endpoints

Language was based on Framework and expanded into Matrices

Mathematical Practices

1. Make sense of problems and persevere in solving them;
2. Reason abstractly and quantitatively;
3. Construct viable arguments and critique the reasoning of others;
4. Model with mathematics;
5. Use appropriate tools strategically
6. Attend to precision.
7. Look for and make use of structure
8. Look for and express regularity in repeated measuring

Practices of Science and Engineering

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

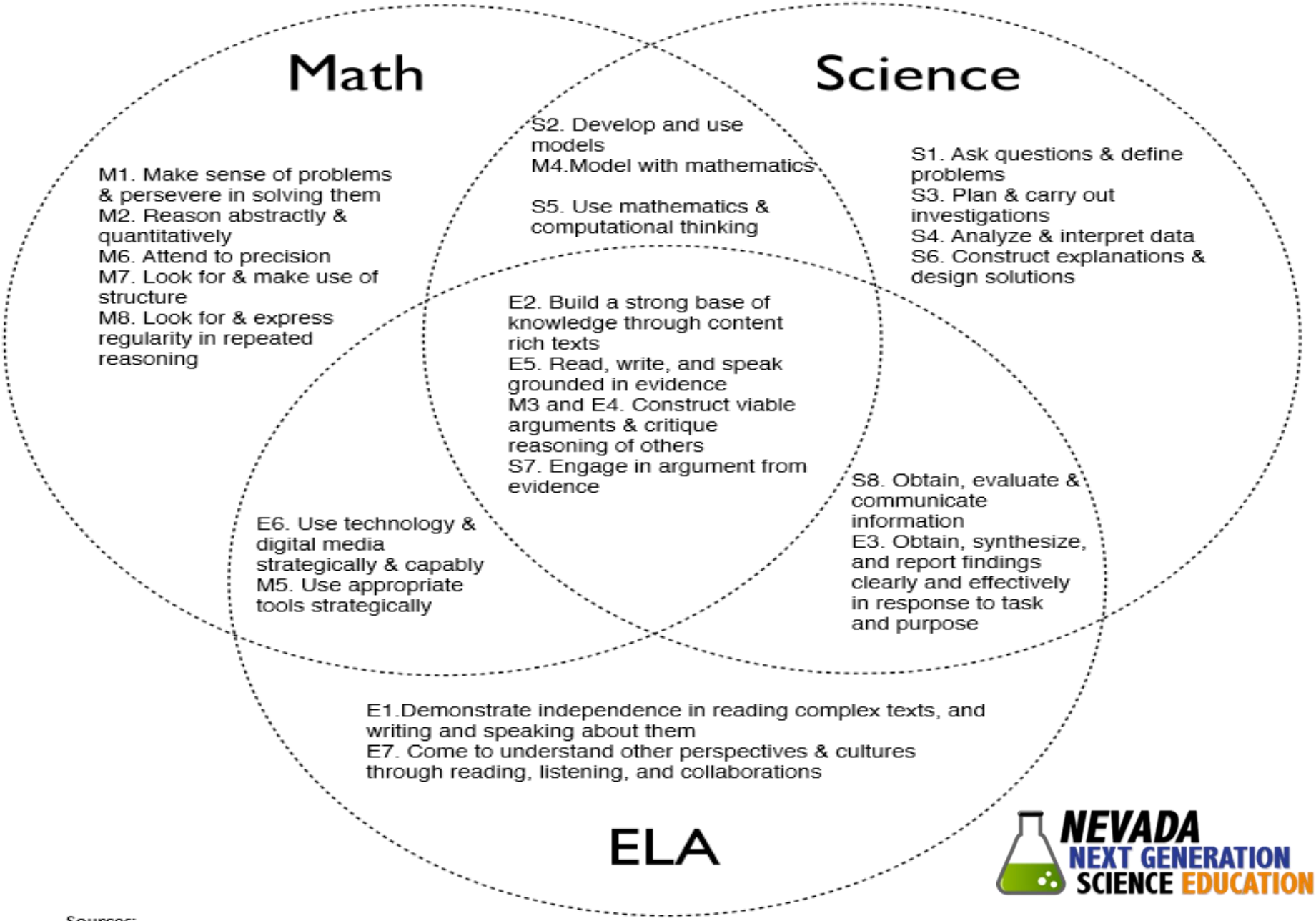
Practices in Mathematics, Science, and English Language Arts*

Math	Science	English Language Arts
M1. Make sense of problems and persevere in solving them.	**S1.** Asking questions (for science) and defining problems (for engineering).	**E1.** They demonstrate independence.
M2. Reason abstractly and quantitatively.	**S2.** Developing and using models.	**E2.** They build strong content knowledge.
M3. Construct viable arguments and critique the reasoning of others.	**S3.** Planning and carrying out investigations.	**E3.** They respond to the varying demands of audience, task, purpose, and discipline.
M4. Model with mathematics.	**S4.** Analyzing and interpreting data.	**E4.** They comprehend as well as critique.
M5. Use appropriate tools strategically.	**S5.** Using mathematics, information and computer technology, and computational thinking.	**E5.** They value evidence.
M6. Attend to precision.	**S6.** Constructing explanations (for science) and designing solutions (for engineering).	**E6.** They use technology and digital media strategically and capably.
M7. Look for and make use of structure.	**S7.** Engaging in argument from evidence.	**E7.** They come to understanding other perspectives and cultures.
M8. Look for and express regularity in repeated reasoning.	**S8.** Obtaining, evaluating, and communicating information.	

* The Common Core English Language Arts uses the term "student capacities" rather than the term "practices" used in Common Core Mathematics and the Next Generation Science Standards.

NGSS@NSTA
STEM STARTS HERE

CCSS ELA, Math and NGSS Practices



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Sources:

Depth of Knowledge: (DOK) - Level 4

- **Conduct a project that requires specifying a problem, designing and conducting an experiment, analyzing its data, and reporting results or solutions.**

Both the CCSS (ELA & Math) and NGSS emphasize *problem solving* and *critical thinking* that require all children to perform at DOK4

Didactic or direct instruction approaches do not meet the DOK4 requirement as it would just be following directions to seek an already known answer. Both sets of standards working together will allow teachers to help children reach DOK4

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Preparing Nevada Students for Success

Why NGSS…

- Students will be able to apply science and engineering practices to real-world problems.
- Students will be better prepared for entering the STEM workforce.
- Students will be college- and career-ready.
- Students will graduate as scientifically-literate citizens.

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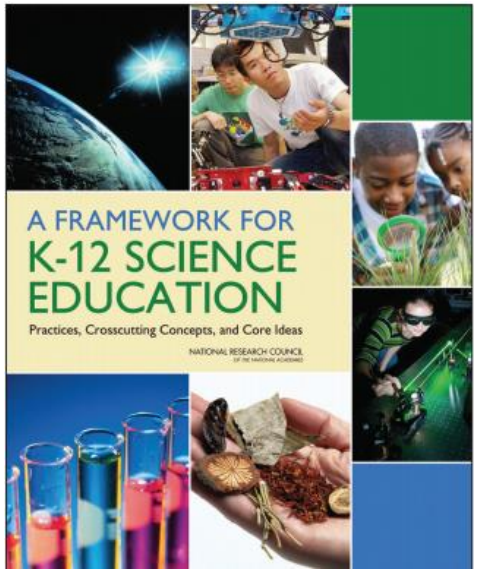
Why NGSS…

- Establish statewide and nationwide united student performance expectations.
- Provide a greater consistency among Nevada school districts (rural and urban).
- Provide equitable learning opportunities for diverse learners from all demographic groups (“All Standards All Students”).
- Provide a greater opportunity for the inclusion of the 21st Centry Skills.

The NGSS improve Nevada science education as part of a nationwide collaboration.



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NEXT GENERATION SCIENCE STANDARDS

- Assessments
- Curricula
- Instruction
- Teacher development

Nevada NGSE Website

Transitioning science to the next generation for ALL students...

Quality science education is critical for developing students to be critical thinkers and problem solvers. Learn more about Nevada NGSE and our mission!

Learn More »

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An Outreach Mission Of Southern Nevada RP DP

- Framework
- NGSS
- Professional Development
- Science Matters

Signup today and stay current with Nevada NGSE!

First Name: | Last Name: | Email: | Submit

Framework

Using Systems and Models in Science Education – Supporting CCC #4

Published: May 26, 2013

"Modeling is also a tool that students can use in gauging their own knowledge and clarifying their questions about a system. Student-developed models may reveal problems or progress in their conceptions of the system, just ...

read more »

NGSS

Next Generation Science Standards Released!

Published: May 22, 2013

NEXT GENERATION SCIENCE STANDARDS

The final NGSS have been released! Included in this release are connections to the Common Core State Standards in ELA & Math. NGSS is available online via interactive search boxes that allow users to narrow ...

read more »

Nevada NGSE Website

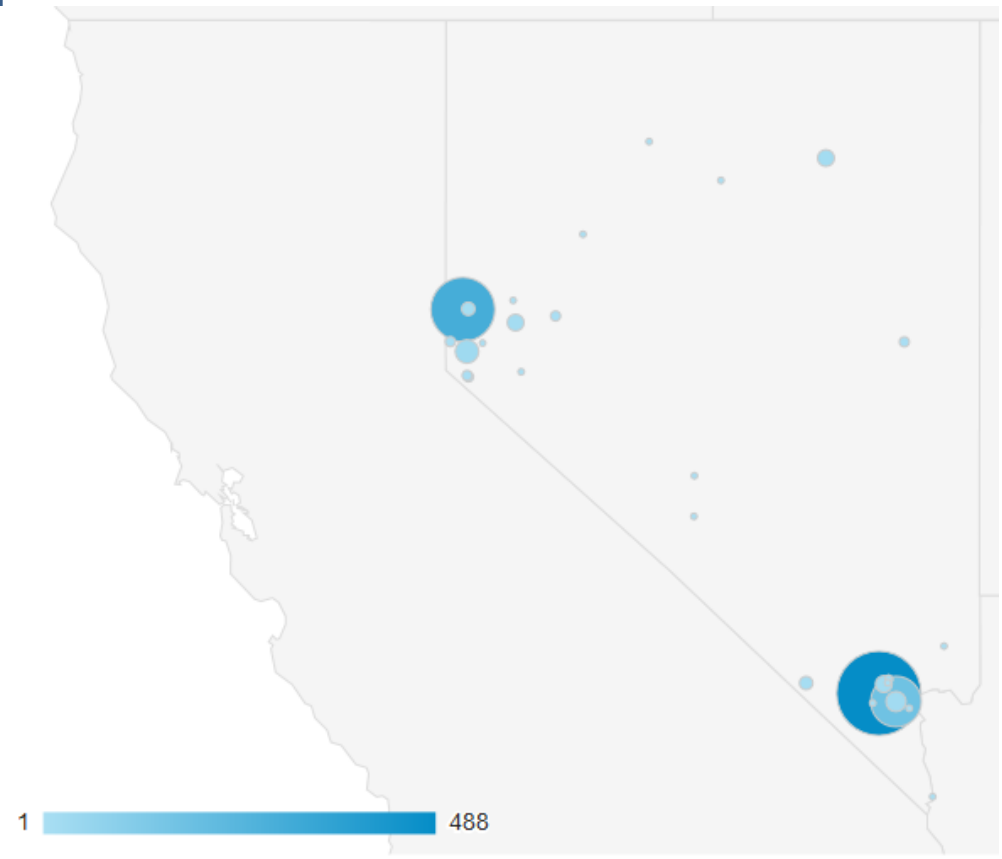
- One-stop shop for pertinent information for Nevada
  - Ensures access to accurate information for ALL
  - Join the discussion: leave comments or write a news story for inclusion on the site
  - Downloadable resources & links to additional resources

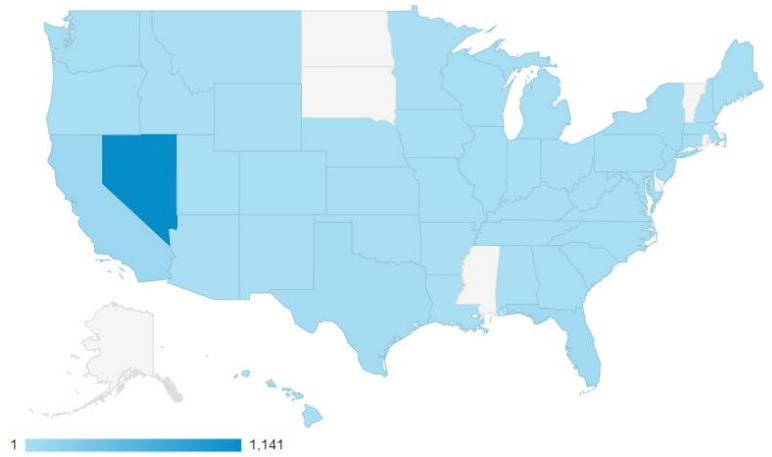
Nevada NGSE Website

- Establishment of the Nevada NGSE Network
  - Constant Contacts Newsletters
  - Social Media: Facebook and Twitter
  - Creation of a database of invested stakeholders
    - 282 Active Contacts and growing

Nevada NGSE Website

- Google Analytics provides data for targeting!
  - 1,834 people have visited the site





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Nevada's Proposed Timeline

- **Review of the N.G.S.S.** – June 13-14 2013
- **Council to Establish Academic Standards for Public Schools' adoption** –August 23, 2013
- **State Board of Education's workshop** – September 4, 2013
- **State Board of Education's adoption:** October 2013
- **Implementation of NGSS (initial):** Fall 2014
- **Implementation of NGSS (full):** Fall 2015

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Questions?

Resources

- Lee, O., Quinn, H., & Valdés, G. (in press). Science and language for English language learners in relation to Next Generation Science Standards and with implications for Common Core State Standards for English language arts and mathematics. *Educational Researcher.*
- Quinn, H., Lee, O., & Valdés, G. (2012). *Language demands and opportunities in relation to the Next Generation Science Standards.* http://ell.stanford.edu/publication/3-language-demands-and-opportunities-relation-next-generation-science-standards-ells
- *Diversity and Equity in the NGSS: All standards, all students.* http://www.nextgenscience.org/next-generation-science-standards
- K-12 Science Framework http://www.nap.edu/catalog.php?record_id=13165
- Nevada Next Generation Science Education: www.NevadaNGSE.net
- Next Generation Science Standards: http://www.nextgenscience.org/
- Nevada Department of Education –Science www.doe.nv.gov/APAC_Science/

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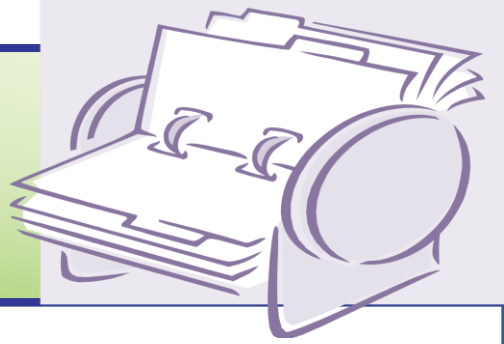
Contact Information



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